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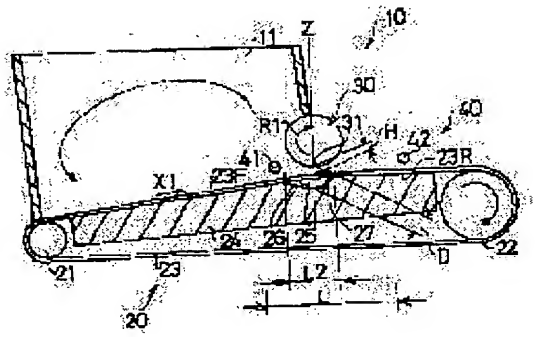
(54) COIN SEPARATING AND FEEDING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To extremely reduce the occurrence of engagement of two coins and to automatically eliminate the engagement or two coins when it occurs.
SOLUTION: While two coins are engaged between a conveyer face 23F of conveyer belt 23 and a counter peripheral face 31 of separator roller 30, a recessed part 25 is provided for displacing the conveyer face 23F away from the separator roller 30 within the thickness of relevant two coins from the counter peripheral face 31 of separator roller 30 while utilizing external force applied from the side of relevant coins. Further, the conveyer belt 23 and the separator roller 30 are formed so as to be inverted when the engagement of two coins is detected.



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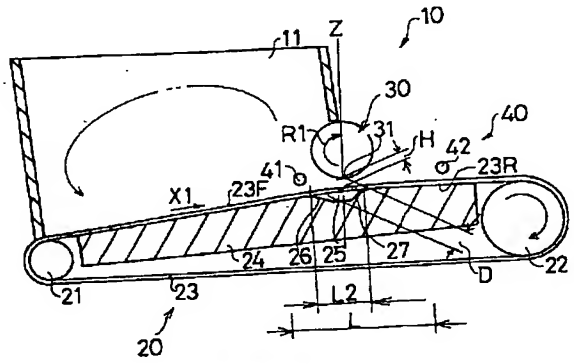
(54)【発明の名称】　硬貨分離送出装置

(57)【要約】
【課題】２枚噛込み発生の極減化および２枚噛込みが発生した場合に自動的に解消可能とする。
【解決手段】搬送ベルト２３の搬送面２３Ｆと分離ローラ３０の対向周面３１との間に２枚の硬貨Ｃ１，Ｃ２が噛込まれつつある場合に、当該硬貨Ｃ１，Ｃ２側から与えられる外力を利用して搬送面２３Ｆが分離ローラ３０の対向周面３１から当該硬貨Ｃ１，Ｃ２の２枚分の厚さ未満内で分離ローラ３０から離れる方向に変位可能とする凹部２５を設けた。さらに、２枚噛込みが検出された場合には、搬送ベルト２３と分離ローラ３０とを逆転可能に形成した。



１０　硬貨分離送出装置
２３　搬送ベルト
２３Ｆ　搬送面
２３Ｒ　非搬送面
２４　ガイド板
２５　凹部
３０　分離ローラ
３１　対向周面
Ｃ１，Ｃ２　硬貨
ｄ　硬貨の厚み
Ｘ１　硬貨搬送方向
Ｒ１　分離方向
Ｈ　隙間（間隔）
θ１，θ２　傾斜角度

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【特許請求の範囲】

【請求項１】　硬貨を硬貨搬送方向に搬送する搬送ベルトと，この搬送ベルトの搬送面に硬貨１枚が通過し得る間隔をもって対向配設されかつ対向周面が硬貨搬送方向と逆の分離方向に回転可能な分離ローラとを具備してなる硬貨分離送出装置において、

前記搬送ベルトの搬送面と前記分離ローラの対向周面との間に２枚の硬貨が噛込まれつつある場合に、当該硬貨側から与えられる外力を利用して搬送面が分離ローラの対向周面から当該硬貨の２枚分の厚さ未満内で分離ローラから離れる方向に変位可能に形成した、ことを特徴とする硬貨分離送出装置。

【請求項２】　硬貨を硬貨搬送方向に搬送する搬送ベルトと，この搬送ベルトの搬送面に硬貨１枚が通過し得る間隔をもって対向配設されかつ対向周面が硬貨搬送方向と逆の分離方向に回転可能な分離ローラとを具備してなる硬貨分離送出装置において、

前記搬送ベルトの非搬送面に接触して当該搬送ベルトを前記硬貨搬送方向に搬送可能にガイドするガイド板の前記分離ローラの対向周面に対応する位置に凹部を形成し、かつこの凹部が搬送ベルトの搬送面と分離ローラの対向周面との間に２枚の硬貨が噛込まれつつある場合に当該硬貨側から与えられる外力により搬送面が分離ローラの対向周面から当該硬貨２枚分の厚さ未満内で分離ローラから離れる方向に変位することを許容可能に形成されている、ことを特徴とする硬貨分離送出装置。

【請求項３】　前記凹部が、前記硬貨搬送方向の上流側の立下り傾斜角度よりもその下流側の立上り傾斜角度が大きいものと形成されている請求項２記載の硬貨分離送出装置。

【請求項４】　前記搬送面と前記対向周面との間に２枚の硬貨が噛込まれたことが検出された場合に前記搬送ベルトが前記硬貨搬送方向とは逆方向に移行可能かつ前記分離ローラが前記分離方向とは逆の方向に回転可能に形成されている請求項３記載の硬貨分離送出装置。

【請求項５】　前記凹部の前記硬貨搬送方向の寸法が硬貨の最小直径未満とされている請求項２から請求項４までのいずれか１項に記載された硬貨分離送出装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、硬貨を硬貨搬送方向に搬送する搬送ベルトと，この搬送ベルトの搬送面に硬貨１枚が通過し得る間隔をもって対向配設されかつ対向周面が硬貨搬送方向と逆の分離方向に回転可能な分離ローラとを具備してなる硬貨分離送出装置に関する。

【０００２】

【従来の技術】硬貨分離送出装置は、例えば商品販売データ処理装置に組込まれた自動釣銭機，銀行業務データ処理装置に組込まれた硬貨包装機等々の一部または全部として多用されている。

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【０００３】図５において、硬貨分離送出装置１０は、大別して、硬貨収納部１１と搬送手段２０と分離ローラ３０とからなる。

【０００４】搬送手段２０は、両ローラ２１，２２間に張設された搬送ベルト２３を硬貨搬送（Ｘ１）方向に移行させつつ搬送面（ベルト表面）２３Ｆで硬貨を搬送する。非搬送面（ベルト裏面）２３Ｒは、ガイド板２４にガイドされている。ガイド板２４の形状は種々あるが、少くとも分離領域Ｌ内ではベルト裏面（２３Ｒ）に全面的に接触するものとされている。分離領域Ｌは、絶対的なものでなく、後記隙間Ｈを保持するために必要とする寸法であればよい。

【０００５】分離ローラ３０は、搬送ベルト２３の搬送面２３Ｆに図６に示す硬貨（Ｃ）１枚が通過可能かつ硬貨２枚が通過不能に設定されたＺ軸線方向の図５に示す隙間（間隔）Ｈをもって対向配設されかつ対向周面３１が硬貨搬送（Ｘ１）方向と逆の分離（Ｒ１）方向に回転可能である。１枚硬貨の厚みがｄの場合、Ｈ＜２ｄとされる。例えば、１．８ｍｍの５００円玉の場合は２．０ｍｍとされる。

【０００６】なお、ガイド板２４は、上記隙間Ｈを正確に保持する他、硬貨収納部１１内においてかつ分離ローラ３０からの付与力を利用して２点鎖線で示すように硬貨の環流化を促進するために、分離ローラ３０に至るまでは図で右上り傾斜とされている。

【０００７】かくして、搬送面２３Ｆ上の硬貨Ｃは隙間Ｈを通して搬送され、かつその上に重なった硬貨Ｃは分離ローラ３０により硬貨収納部１１側へ戻される。したがって、硬貨を１枚ずつ図５で右方向に分離送出することができる。

【０００８】

【発明が解決しようとする課題】ところで、隙間Ｈは、硬貨２枚分の厚さ（２ｄ）よりも小さいので、図６に示す２枚の硬貨Ｃ１，Ｃ２が重なったまま送出されてしまうことはないが、重なり具合や搬送ベルト２３および／または分離ローラ３０の弾性特性によっては、２枚の硬貨Ｃ１，Ｃ２が搬送面２３Ｆと分離ローラ３０との間に噛込まれてロック状態になってしまう場合がある。

【０００９】かかる場合は、搬送ベルト２３を図６の点線で示すＸ２方向に逆転させることが試みられているが、２枚噛込みを必ず解消できるという保障はない。特に、図６に示す上の硬貨Ｃ２の先端側Ｃ２２が下の硬貨Ｃ１の先端側Ｃ１２よりもＸ１方向に突出しかつその先端側Ｃ１２を下方に押込むとともに分離ローラ３０の弾性変形部３９によりさらに下方に押され、しかも両硬貨Ｃ１，Ｃ２が図で左上りに傾斜するから、下の硬貨Ｃ１と搬送面２３の接触部２９との接触面積が非常に小さくなる状態では、人手による引抜きを必要とする程に強く噛込まれてしまうからである。

【００１０】この困難性は、図５に示す例えば２つのセ

ンサー４１，４２を含む２枚噛込み検出手段４０（例えば、特開昭５７－１５００９０号公報）を設けていることからもうかがい知れる。換言すれば、人手によるロック状態の早期解消のための２枚噛込みの早期検出に力点が置かれ、噛込み発生の軽減化および噛込み発生後の自動的解消化については改善の余地がある。

【００１１】本発明の目的は、２枚噛込みの発生を極減化することができる硬貨分離送出装置を提供することにある。また、第２の目的は、２枚噛込みが発生した場合に自動的に解消できる硬貨分離送出装置を提供することにある。

【００１２】

【課題を解決するための手段】２枚硬貨の噛込みが発生しつつある場合あるいは発生してしまった場合には、硬貨側から搬送ベルト側および分離ローラ側に抗力が発生する。本発明は、この点に着目し、その抗力（外力）を巧みに利用しつつ搬送ベルトを分離ローラと離れる方向に変位させつつ上下硬貨の係合具合、姿勢変化を誘発しつつ前記目的を達成可能とするものである。

【００１３】すなわち、請求項１の発明は、硬貨を硬貨搬送方向に搬送する搬送ベルトと，この搬送ベルトの搬送面に硬貨１枚が通過し得る間隔をもって対向配設されかつ対向周面が硬貨搬送方向と逆の分離方向に回転可能な分離ローラとを具備してなる硬貨分離送出装置において、前記搬送ベルトの搬送面と前記分離ローラの対向周面との間に２枚の硬貨が噛込まれつつある場合に、当該硬貨側から与えられる外力を利用して搬送面が分離ローラの対向周面から当該硬貨の２枚分の厚さ未満内で分離ローラから離れる方向に変位可能に形成した、ことを特徴とする。

【００１４】かかる発明では、搬送ベルトの搬送面と分離ローラの対向周面との間に２枚の硬貨が噛込まれつつある場合には、硬貨側からの外力によって搬送面が分離ローラから離れる方向に変位する。変位量は、分離ローラの対向周面から当該硬貨の２枚分の厚さ未満内である。したがって、２枚の硬貨の先端側は変位した搬送面とともに下方に落込むのでそれらの後端側は跳上り、上の硬貨と分離ローラとの接触面が増大しかつ下の硬貨と搬送面との接触面とは減少し、しかも下の硬貨の先端側は変形した搬送ベルトで搬送方向への移行が阻止される。さらに、上の硬貨の下面と下の硬貨の上面との金属間摩擦抵抗は分離ローラと上の硬貨の上面との摩擦抵抗よりも遥かに小さい。かくして、上の硬貨を分離ローラの付与力によって分離方向に戻すことができるから、ロック状態となる噛込みの発生を極減化できる。

【００１５】また、請求項２の発明は、硬貨を硬貨搬送方向に搬送する搬送ベルトと，この搬送ベルトの搬送面に硬貨１枚が通過し得る間隔をもって対向配設されかつ対向周面が硬貨搬送方向と逆の分離方向に回転可能な分離ローラとを具備してなる硬貨分離送出装置において、

前記搬送ベルトの非搬送面に接触して当該搬送ベルトを前記硬貨搬送方向に搬送可能にガイドするガイド板の前記分離ローラの対向周面に対応する位置に凹部を形成し、かつこの凹部が搬送ベルトの搬送面と分離ローラの対向周面との間に２枚の硬貨が噛込まれつつある場合に当該硬貨側から与えられる外力により搬送面が分離ローラの対向周面から当該硬貨２枚分の厚さ未満内で分離ローラから離れる方向に変位することを許容可能に形成されている、ことを特徴とする。

【００１６】かかる発明では、搬送ベルトの搬送面と分離ローラの対向周面との間に２枚の硬貨が噛込まれつつある場合には、硬貨側からの外力が搬送面を分離ローラから離れる方向へ押す。ガイド板に設けられた凹部は、分離ローラの対向周面から当該硬貨２枚分の厚さ未満内で、搬送ベルトの変位を許容する。したがって、請求項１の発明の場合と同様な作用効果を奏し得る他、さらにガイド板の分離ローラとの対向する部位に凹部を形成するだけでよいので、構造簡単で低コストで具現化できる。

【００１７】また、請求項３の発明は、前記凹部が、前記硬貨搬送方向の上流側の立下り傾斜角度よりもその下流側の立上り傾斜角度が大きいものと形成されている硬貨分離送出装置である。

【００１８】かかる発明では、凹部の硬貨搬送方向の下流側の立上り傾斜角度が大きいので噛込みつつある上の硬貨の硬貨搬送方向への移行をより阻止し易くかつ噛込み程度を軽くすることができるとともに、上流側の立下り傾斜角度が小さいので下の硬貨の傾きを小さくできる。つまり、上の硬貨の下面と下の硬貨の上面との接触面積をより小さくできる。したがって、請求項１および請求項２の発明の場合と同様な作用効果に加え、さらに噛込みの発生をより極減化でき完全防止も可能である。

【００１９】さらに、請求項４の発明は、前記搬送面と前記対向周面との間に２枚の硬貨が噛込まれたことが検出された場合に前記搬送ベルトが前記硬貨搬送方向とは逆方向に移行可能かつ前記分離ローラが前記分離方向とは逆の方向に回転可能に形成されている硬貨分離送出装置である。

【００２０】かかる発明では、例えば硬貨の厚みバラツキや導入時の姿勢等々の事由発生によって２枚硬貨の噛込みが発生した場合に、これが検出されると搬送ベルトの移行方向と分離ローラの回転方向とを硬貨搬送時と逆にする。すると、上の硬貨は凹部の立上り傾斜角度の大きな凹部の下流側に突当てられたままとなり、下の硬貨は凹部の立下り傾斜角度が小さい上流側に沿ったベルトの搬送面との接触面積が大きくなる。つまり、搬送方向と逆方向への戻り力が増大するから円滑に戻される。したがって、請求項３の発明の場合と同様な作用効果に加え、万一噛込みが発生した場合でも自動的に解消できる。

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【００２１】さらにまた、請求項５の発明は、前記凹部の前記硬貨搬送方向の寸法が硬貨の最小直径未満とされている硬貨分離送出装置である。

【００２２】かかる発明では、最小直径の硬貨でも凹部内に全部が落込んでしまうことがない。したがって、請求項１から請求項４までの発明の場合と同様な作用効果に加え、直径の異なる複数種類の硬貨が混在している場合でも、２枚硬貨の噛込み発生防止と発生後の自動的解消を保障できる。

【００２３】

【発明の実施の形態】以下、本発明の実施形態を図面を参照して説明する。本硬貨分離送出装置１０は、図１に示す如く、基本的構成（１１，２０，３０，４０）が従来例（図５）の場合と同様とされているが、さらに搬送ベルト２３の搬送面２３Ｆと分離ローラ３０の対向周面３１との間に２枚の硬貨Ｃ１，Ｃ２が噛込まれつつある場合に、当該硬貨Ｃ１，Ｃ２側から与えられる外力を利用して搬送面２３Ｆが分離ローラ３０の対向周面３１から当該硬貨Ｃ１，Ｃ２の２枚分の厚さ（２ｄ）未満内で分離ローラ３０から離れる方向に変位可能に形成されている。

【００２４】なお、従来例（図５）の場合と共通する部分については同一の符号を付し、それらの構成・機能についての説明は簡略化または省略する。

【００２５】図１において、ガイド板２４の搬送ベルト２３の非搬送面２３Ｒと接触する上面側で分離ローラ３０と対向する分離領域Ｌ（図５参照）内に凹部２５が設けられている。この凹部２５は、搬送ベルト２３の搬送面２３Ｆと分離ローラ３０の対向周面３１との間に２枚の硬貨（図２に示すＣ１，Ｃ２）が噛込まれつつある場合や噛込まれた場合に、当該硬貨Ｃ１，Ｃ２側から与えられる外力（抗力）を利用して搬送面２３Ｆが対向周面３１から当該硬貨の２枚分の厚さ（２ｄ）未満内で分離ローラ３０から離れる方向（図１で下方）に変位することを許容する機能を有する。

【００２６】すなわち、凹部２５の最大深さＤは、硬貨Ｃ１（Ｃ２）の厚さをｄとした場合に、Ｄ＜２ｄとして決める。２枚硬貨Ｃ１，Ｃ２の図１で右方向への通過防止のためである。最大深さＤは、厚さ１．８ｍｍの５００円玉の場合、例えば３．４ｍｍとされる。

【００２７】また、凹部２５のＸ１方向の下流側の立上り傾斜角度θ２は、図２に示す如く、同一基準線Ｑに対して上流側の立下り傾斜角度θ１よりも大きくされている。下流側の傾斜角度θ２は、２枚硬貨Ｃ１，Ｃ２が噛込みつつある場合に上の硬貨Ｃ２の先端Ｃ２２がＸ１方向に移行することを防止するためのブレーキ面を構成するものとして大きくされている。上流側の傾斜角度θ１は、下の硬貨Ｃ１と搬送面２３Ｆとの接触面積を増大するために小さくされている。下の硬貨Ｃ１の姿勢をより水平化するためでもある。

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【００２８】さらに、傾斜角度θ１とθ２との差は、下の硬貨Ｃ１の上面と上の硬貨Ｃ２の下面との間の角度を大きくして上の硬貨Ｃ２の上面と下の硬貨Ｃ１の下面との接触面積を小さくするために設けられている。さらにまた、２枚硬貨Ｃ１，Ｃ２の完全落込み防止のために図１に示す硬貨搬送（Ｘ１）方向の寸法Ｌ２は、硬貨の最小直径よりも小さいものとされている。なお、最小直径の半分（１／２）よりも大きくすることが望ましい。適用硬貨が１種類の場合は、当該硬貨の直径ｄ未満とする。

【００２９】搬送ベルト２３の少くとも搬送面２３Ｆと分離ローラ３０の少くとも周面とは、この実施形態の場合は、硬度が７２度（ＪＩＳ　Ａ）のポリウレタンゴム（ＨＮＢＲ）とされている。常態では、搬送ベルト２３は硬貨Ｃの重みだけでは凹部２５内に変位しない。

【００３０】なお、２枚噛込み検出手段４０は、上流側センサ４１と下流側センサ４２との硬貨検出動作のタイミングずれを利用して２枚噛込み検出可能とされている。制御部（図示省略）は、２枚噛込み（硬貨詰り）が検出された場合（図３のＳＴ１０のＹＥＳ）には、正常時の場合（ＳＴ１１，ＳＴ１２）とは逆にそれらの方向を切替える（ＳＴ１３，ＳＴ１４）。

【００３１】次に、この実施形態の作用・動作を説明する。正常時には、図１に示す如く、搬送ベルト２３（２３Ｆ）はＸ１方向に移行（図３のＳＴ１１）されかつ分離ローラ３０はＲ１方向に回転（ＳＴ１２）されている。隙間Ｈは、２枚硬貨Ｃ１，Ｃ２の厚さ（２ｄ）よりも小さいので、硬貨を１枚ずつ送出できる。つまり、上の硬貨Ｃ２は分離ローラ３０で戻され、下の硬貨Ｃ１のみが隙間Ｈを通過する。また、搬送ベルト２３（２３Ｆ）は、１枚の硬貨が乗るだけであるから、凹部２５側に変位しない。

【００３２】ここに、２枚硬貨Ｃ１，Ｃ２が、搬送ベルト２３（搬送面２３Ｆ）と分離ローラ３０（対向周面３１）との間に図２（Ａ）に示すように噛込みつつある場合は、２枚硬貨Ｃ１，Ｃ２側から搬送ベルト２３に下向きの外力が加わる。すると、搬送ベルト２３は凹部２５内に変位する。

【００３３】上の硬貨Ｃ２の先端側Ｃ２２は、急傾斜面（２７）に沿った搬送面２３Ｆに突当たり、下流側への移行が阻止される。また、下の硬貨Ｃ１は、緩傾斜面（２６）に沿った搬送面２３Ｆに押当てられる。両者Ｃ１，Ｃ２は、左上りに傾斜するから、上の硬貨Ｃ２の上面と分離ローラ３０の接触部３２との接触面積が増大する。しかも、この接触面積は、上の硬貨Ｃ２の左上り傾斜角度が大きくなる程に増大率が大きい。

【００３４】この際、下の硬貨Ｃ１は、Ｘ１方向に移行しようとするが、凹部２５の底部に向う姿勢であるから、上の硬貨Ｃ１に与えるＸ１方向の分力は小さい。しかも、上の硬貨Ｃ２の下面と下の硬貨Ｃ１の上面とは、

金属同士の接触であるから摩擦抵抗は小さい。したがって、図２（Ｂ）に示す如く、下の硬貨Ｃ１は搬送ベルト２３の変曲部２３Ａに突当りＸ１方向へ移行できない。上の硬貨Ｃ２は分離ローラ３０（３２）から力でＸ２２方向に戻される。つまり、２枚硬貨Ｃ１，Ｃ２のロック状態となる噛込み発生を未然に防止することができる。

【００３５】ところで、２枚硬貨Ｃ１，Ｃ２が図３（Ａ）に示すようにロック状態の噛込みが発生すると、２枚噛込み検出手段４０が働く。制御部は、搬送ベルト２３をＸ２方向に移行させかつ分離ローラ３０をＲ２方向に回転させる（図３のＳＴ１０のＹＥＳ，ＳＴ１３，ＳＴ１４）。

【００３６】この場合は、上の硬貨Ｃ２の先端側Ｃ２２が凹部２５の急傾斜面（２７）に沿った搬送ベルト２３（２３Ｆ）に突当りＸ１方向には移行できない。一方、下の硬貨Ｃ１は緩傾斜面（２６）に沿った搬送ベルト２３（２３Ｆ）に接触するので接触面積が増大する。しかも、Ｘ２方向に付勢される。したがって、図４（Ｂ）に示すように、上の硬貨Ｃ２が位置規制されたままの状態で、下の硬貨Ｃ１がＸ２２方向に移行される。

【００３７】かくして、従来例および図２（Ｂ）において、分離ローラ３０により上の硬貨Ｃ２をＸ１乃至Ｘ２２方向に戻すという考え方とは異なる新規な動作原理を導入することにより、ロック状態の２枚硬貨噛込みを自動的に解消することができるわけである。

【００３８】しかして、この実施形態によれば、搬送ベルト２３の搬送面２３Ｆと分離ローラ３０の対向周面３１との間に２枚の硬貨Ｃ１，Ｃ２が噛込まれつつある場合に、当該硬貨側から与えられる外力を利用して搬送面２３Ｆが分離ローラ３０の対向周面３１から当該硬貨の２枚分の厚さ未満内で分離ローラ３０から離れる方向に変位可能に形成されているので、ロック状態となる噛込みの発生を極減化することができる。

【００３９】また、搬送ベルト２３の非搬送面２３Ｒに接触して当該搬送ベルト２３を硬貨搬送（Ｘ１）方向に搬送可能にガイドするガイド板２４の分離ローラ３０の対向周面３１に対応する位置に凹部２５を形成し、かつこの凹部２５が搬送ベルト２３の搬送面２３Ｆと分離ローラ３０の対向周面３１との間に２枚の硬貨が噛込まれつつある場合に当該硬貨側から与えられる外力により搬送面２３Ｆが分離ローラ３０の対向周面３１から当該硬貨２枚分の厚さ未満内で分離ローラ３０から離れる方向に変位することを許容可能に形成されているので、構造簡単で低コストで具現化できる。

【００４０】また、凹部２５の硬貨搬送方向の上流側の立下り傾斜角度θ１よりもその下流側の立上り傾斜角度θ２が大きいものと形成されているので、さらに噛込みの発生をより確実に極減化できる。

【００４１】さらに、搬送面２３Ｆと対向周面３１との間に２枚の硬貨Ｃ１，Ｃ２が噛込まれたことが検出された場合に搬送ベルト２３が硬貨搬送（Ｘ１）方向とは逆（Ｘ２）方向に移行されかつ分離ローラ３０が分離（Ｒ１）方向とは逆のＲ２方向に回転されるものと形成されているので、万一噛込みが発生した場合でも自動的に解消できる。

【００４２】さらにまた、凹部２５の硬貨搬送（Ｘ１）方向の寸法Ｌ２が硬貨の最小直径未満とされているので、直径ｄの異なる複数種類の硬貨が混在している場合でも、２枚硬貨の噛込み発生防止と発生後の自動的解消を保障できる。

【００４３】さらにまた、搬送ベルト２３と分離ローラ３０とが、ＪＩＳ　Ａの硬度が７２度のポリウレタンゴムから形成されているので、正常時には搬送ベルト２３が凹部２５側に変位することなく、また２枚噛込みしつつある場合にはその外力によって凹部２５形状に沿って変形・変位することができる。

【００４４】なお、硬貨（Ｃ）の厚みをｄとした場合に、隙間Ｈ＜２ｄ，凹部２５の許容変位Ｄ＜２ｄであれば、硬貨収容部１１に厚みの異なる硬貨が混在している場合にもそのまま適用できる。

【００４５】例えば、現行の最小直径を持つ硬貨（１円玉）の厚さｄ１は１．５ｍｍで、最大直径を持つ硬貨（５００円玉）の厚さｄ５００は１．８ｍｍであるから、Ｈ＝Ｄ＜（２×ｄ１）とすればよいと理解される。

【００４６】

【発明の効果】請求項１の発明によれば、搬送ベルトの搬送面と分離ローラの対向周面との間に２枚の硬貨が噛込まれつつある場合に、当該硬貨側から与えられる外力を利用して搬送面が分離ローラの対向周面から当該硬貨の２枚分の厚さ未満内で分離ローラから離れる方向に変位可能に形成されているので、ロック状態となる噛込み発生を極減化できる。

【００４７】また、請求項２の発明によれば、搬送ベルトの非搬送面に接触して当該搬送ベルトを硬貨搬送方向に搬送可能にガイドするガイド板の分離ローラの対向周面に対応する位置に凹部を形成し、かつこの凹部が搬送ベルトの搬送面と分離ローラの対向周面との間に２枚の硬貨が噛込まれつつある場合に当該硬貨側から与えられる外力により搬送面が分離ローラの対向周面から当該硬貨２枚分の厚さ未満内で分離ローラから離れる方向に変位することを許容可能に形成されているので、請求項１の発明の場合と同様な効果を奏し得る他、さらにガイド板の分離ローラとの対向する部位に凹部を形成するだけでよいので構造簡単で低コストで具現化できる。

【００４８】また、請求項３の発明によれば、凹部が硬貨搬送方向の上流側の立下り傾斜角度よりもその下流側の立上り傾斜角度が大きいものと形成されているので、請求項１および請求項２の発明の場合と同様な効果に加え、さらに噛込みの発生をより極減化でき完全防止も可能である。

【００４９】さらに、請求項４の発明によれば、搬送面と対向周面との間に２枚の硬貨が噛込まれたことが検出された場合に搬送ベルトが硬貨搬送方向とは逆方向に移行可能かつ分離ローラが分離方向とは逆の方向に回転可能に形成されているので、請求項３の発明の場合と同様な効果に加え、万一噛込みが発生した場合でも自動的に解消できる。

【００５０】さらにまた、請求項５の発明によれば、凹部の硬貨搬送方向の寸法が硬貨の最小直径未満とされているので、請求項１から請求項４までの発明の場合と同様な効果に加え、直径の異なる複数種類の硬貨が混在している場合でも、２枚硬貨の噛込み発生防止と発生後の自動的解消を保障できる。

【図面の簡単な説明】

【図１】本発明の実施形態を示す側断面図である。

【図２】同じく、２枚硬貨を噛込みつつある場合の解消動作を説明するための図である。

【図３】同じく、２枚硬貨の噛込みが発生した場合の解消動作を説明するための図である。

【図４】同じく、搬送ベルトの移行方向および分離ローラの回転方向の切替動作を説明するためのフローチャートである。

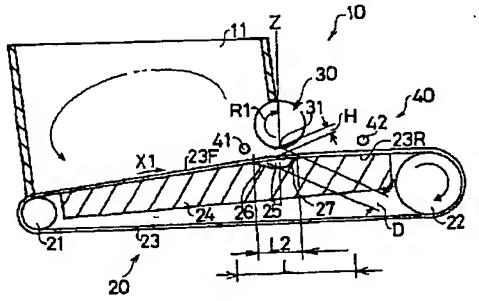
＊【図５】従来例を説明するための側断面図である。

【図６】同じく、噛込みが発生した場合のロック状態を説明するための図である。

【符号の説明】

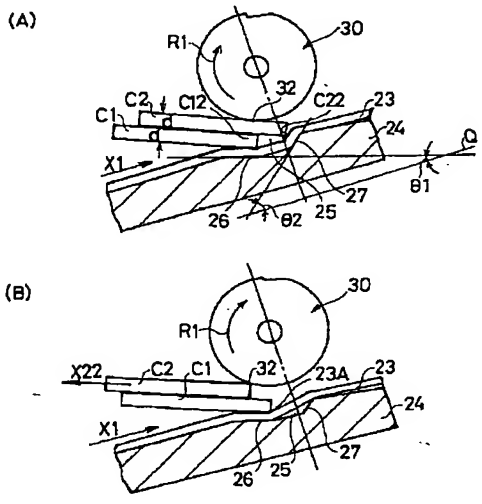
１０　硬貨分離送出装置
１１　硬貨収納部
２０　搬送手段
２１，２２　ローラ
２３　搬送ベルト
２３Ｆ　搬送面
２３Ｒ　非搬送面
２４　ガイド板
２５　凹部
３０　分離ローラ
３１　対向周面
４０　２枚噛込み検出手段
Ｃ１，Ｃ２　硬貨
ｄ　　硬貨の厚み
Ｘ１　硬貨搬送方向
Ｒ１　分離方向
Ｈ　隙間（間隔）
θ１，θ２　傾斜角度

【図１】

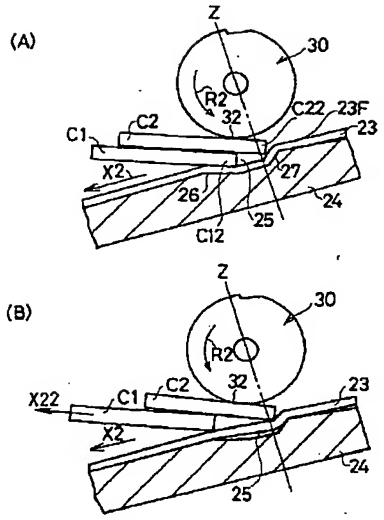


１０　硬貨分離送出装置
２３　搬送ベルト
２３Ｆ　搬送面
２３Ｒ　非搬送面
２４　ガイド板
２５　凹部
３０　分離ローラ
３１　対向周面
Ｃ１，Ｃ２　硬貨
ｄ　硬貨の厚み
Ｘ１　硬貨搬送方向
Ｒ１　分離方向
Ｈ　隙間（間隔）
θ１，θ２　傾斜角度

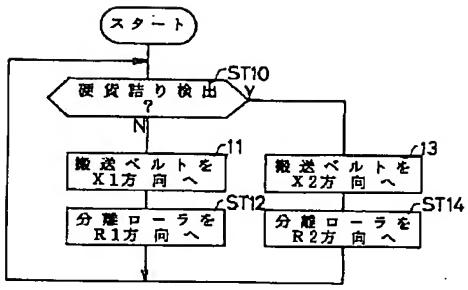
【図２】



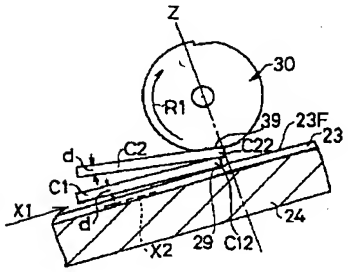
【図３】


(A)
Z
30
R2
32
C1
C2
C22
23F
23
X2
27
26
25
24
C12
(B)
Z
30
R2
X22
C1
C2
32
23
X2
24
25

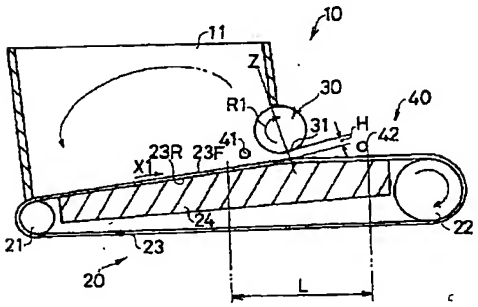
【図４】


スタート
ST10
便貨詰り検出
?
Y
N
11
搬送ベルトを X1方向へ
13
搬送ベルトを X2方向へ
ST12
分離ローラを R1方向へ
ST14
分離ローラを R2方向へ

【図６】


Z
30
R1
39
23F
C2
C22
23
d
C1
X1
d
24
X2
29
C12

【図５】


10
11
Z
30
R1
40
31
H
42
41
23R
23F
X1
24
22
21
23
20
L

DECLARATION

I, Akiko MATSUI, a member of Intertec Corporation of Toranomon Akiyama Bldg., 22-13, Toranomon 1-chome, Minato-ku, Tokyo, Japan do solemnly and sincerely declare that I well understand the Japanese language and English language and the attached English translation is full, true and faithful translation of the Japanese Unexamined Patent Publication No. Hei 10(1998)-269405.

And I made this solemn declaration conscientiously believing the same to be true.

This 27th day of March, 2006

Akiko MATSUI

Unexamined Patent Publication No. Hei 10(1998)-269405

[Title of the Invention] Coin separating/delivery unit

[Abstract]

[Subject]

The occurrence of a pinched state of two coins is to be minimized or the pinched state is to be cancelled automatically upon occurrence thereof.

[Solution]

A recess 25 is provided which permits, when two coins C1 and C2 are being pinched between a conveyance surface 23F of a conveyor belt 23 and an opposed peripheral surface 31 of a separating roller 30, the conveyance surface 23F to be displaced in a direction away from the opposed peripheral surface 31 of the separating roller 30 within a range smaller than the total thickness of the two coins C1 and C2 by utilizing an external force given from the coins C1, C2 side. When the pinched state of the two coins is detected, the conveyor belt 23 and the separating roller 30 can each rotate in the opposite direction.

[Claims]

1. A coin separating/delivery unit comprising: a conveyor belt for conveying coins in a coin conveying direction; and a separating roller disposed in opposition to a conveyance surface of the conveyor belt through a gap which permits one coin to pass therethrough at a time, and having a peripheral surface, which is opposed to the conveyance surface of the conveyor belt, being rotatable in a separating direction opposite to the coin conveying direction,

wherein, when two coins are being pinched between the conveyance surface of the conveyor belt and the opposed peripheral surface of the separating roller, the conveyance surface can be deformed in a direction away from the opposed peripheral surface of the separating roller within a range smaller than the total thickness of the two coins by utilizing an external force given from the coins' side.

2. A coin separating/delivery unit comprising: a conveyor belt for conveying coins in a coin conveying direction; and a separating roller disposed in opposition to a conveyance surface of the conveyor belt through a gap which permits one coin to pass therethrough at a time, and having a peripheral surface, which is opposed to the conveyance surface of the conveyor belt, being rotatable in

a separating direction opposite to the coin conveying direction,

wherein a recess is formed in a guide plate in a position corresponding to the peripheral surface of the separating roller opposed to the conveyance surface of the conveyor belt, the guide plate being in contact with a non-conveyance surface of the conveyor belt to guide the conveyor belt movably in the coin conveying direction, the recess being formed so as to permit the conveyance surface of the conveyor belt to be deformed in a direction away from the opposed peripheral surface of the separating roller within a range smaller than the total thickness of two coins by utilizing an external force given from the coins' side when the two coins are being pinched between the conveyance surface of the conveyor belt and the opposed peripheral surface of the separating roller.

3. A coin separating/delivery unit according to claim, 2, wherein the recess is formed so that a rising inclination angle thereof on a downstream side in the coin conveying direction is larger than a falling inclination angle thereof on an upstream side in the coin conveying direction.

4. A coin separating/delivery unit according to claim 3, wherein when it is detected that two coins are pinched between the conveyance surface and the opposed peripheral

surface, the conveyor belt can move in the direction opposite to the coin conveying direction and the separating roller can rotate in the direction opposite to the separating direction.

5. A coin separating/delivery unit according to any of claims 2 to 4, wherein the size of the recess in the coin conveying direction is set smaller than a minimum coin diameter.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a coin separating/delivery unit comprising: a conveyor belt for conveying coins in a coin conveying direction; and a separating roller disposed in opposition to a conveyance surface of the conveyor belt through a gap which permits one coin to pass therethrough at a time, and having a peripheral surface opposed to the conveyance surface of the conveyor belt and rotatable in a separating direction opposite to the coin conveying direction.

[0002]

[Prior Art]

The coin separating/delivery unit is used frequently as part or the whole of, for example, an automatic change

delivery machine built in a commodity sale data processor or a coin packaging machine built in a band business data processor.

[0003]

In Fig. 5, a coin separating/delivery unit 10 roughly comprises a coin receptacle section 11, conveyor means 20 and a separating roller 30.

[0004]

In the conveyor means 20, coins are conveyed by a conveyance surface (belt surface) 23F while a conveyor belt 23 stretched between both rollers 21 and 22 is moved in a coin conveying direction (X1). A non-conveyance surface (back side of the belt) 23R is guided by a guide plate 24. As the shape of the guide plate 24, various shapes may be adopted, but there is adopted a guide plate shape such that at least in a separation area L the guide plate contacts the whole of the back side (23R) of the belt. The separation area L is not an absolute one but may be of a size which is required for maintaining a gap H to be described later.

[0005]

The separating roller 30 is disposed in opposition to the conveyance surface 23F of the conveyor belt 23 through a gap (spacing) H in Z-axis direction shown in Fig. 5 which

gap H is set so as to permit passage of one coin (C) shown in Fig. 6 and so as not to permit passage of two coins. A peripheral surface 31 of the separating roller 30 opposed to the conveyance surface 23F is rotatable in a separating direction (R1) opposite to the coin conveying direction (X1). In the case where the thickness of one coin is d, the gap H satisfies the relation of H<2d. For example, in the case of 500-yen coin of 1.8 mm in thickness, the gap H is set at 2.0 mm.

[0006]

The guide plate 24, which functions to keep the gap H accurately, is inclined upward on the right side up to reaching the separating roller 30 so that the return of coin is promoted as indicated with a dash-double dot line within the coin receptacle section 11 and by utilizing a force given from the separating roller 30.

[0007]

The coin C on the conveyance surface 23F is conveyed through the gap H, while a coin C superimposed on that coin is returned toward the coin receptacle section 11 by the separating roller 30. Thus, coins can be separated and delivered one by one rightwards in Fig. 5.

[0008]

[Problem to be Solved by the Invention]

Since the gap H is smaller than the total thickness (2d) of two coins, there is no fear that two coins C1 and C2 shown in Fig. 6 may be delivered in a mutually overlapped state, but a certain overlapped state or a certain elastic characteristic of the conveyor belt 23 and/or the separating roller 30 may result in two coins C1 and C2 being pinched into a locked state between the conveyance surface 23F and the separating roller 30.

[0009]

In such a case, an attempt is made to reverse rotate the conveyor belt 23 in X2 direction indicated with a dotted line in Fig. 6, but there is no guarantee that the pinched state of two coins can be surely cancelled. Particularly, in Fig. 6, a front end side C22 of the upper coin C2 projects to a greater extent in X1 direction than a front end side C12 of the lower coin C1 and pushes down the front end side C12; besides, it is further pushed downward by an elastic deforming portion 39 of the separating roller 30 and both coins C1 and C2 are inclined upward on the left side in the figure. Therefore, in a state in which the area of contact between the lower coin C1 and a contact portion 29 of the conveyance surface 23 becomes very small, the coins are pinched strongly to such an extent as requires manual operation to pull out each coin.

[0010]

This difficulty can be seen for example from the provision of two coins pinching detector means 40 including two sensors 41 and 42 (see, for example, Japanese Patent Laid-Open Publication No. Sho 57 (1982)-150090) as shown in Fig. 5. In other words, emphasis is put on early-stage detection of a pinched (locked) state of two coins so that the locked state can be cancelled manually in an early stage. Thus, as to reducing the occurrence of such a pinched state and as to automatic cancellation after the occurrence of the pinched state, there is room for improvement.

[0011]

It is a first object of the present invention to provide a coin separating/delivery unit able to diminish the occurrence of a pinched state of two coins to the extreme degree. It is a second object of the present invention to provide a coin separating/delivery unit able to automatically cancel a pinched state of two coins.

[0012]

[Means for Solving the Problem]

When a pinched state of two coins is occurring or has occurred, a resisting force is developed from the coin side to the conveyor belt side and the separating roller side.

Having paid attention to this point, the present invention can achieve the above-mentioned objects while displacing the conveyor belt in a direction away from the separating roller by utilizing the aforesaid resisting force (external force) effectively and while changing the degree of engagement of both upper and lower coins and the attitude of the coins.

[0013]

More specifically, according to the invention defined in claim 1 there is provided a coin separating/delivery unit comprising: a conveyor belt for conveying coins in a coin conveying direction; and a separating roller disposed in opposition to a conveyance surface of the conveyor belt through a gap which permits one coin to pass therethrough at a time and having a peripheral surface opposed to the conveyance surface of the conveyor belt and rotatable in a separating direction opposite to the coin conveying direction, characterized in that, when two coins are being pinched between the conveyance surface of the conveyor belt and the opposed peripheral surface of the separating roller, the conveyance surface can be deformed in a direction away from the opposed peripheral surface of the separating roller within a range smaller than the total thickness of the two coins by utilizing an external force given from the

coins' side.

[0014]

According to the invention in question, when two coins are being pinched between the conveyance surface of the conveyor belt and the opposed peripheral surface of the separating roller, the conveyance surface is disposed in a direction away from the separating roller under the action of an external force given from the coins' side. The amount of the displacement is smaller than the total thickness of the two coins from the opposed peripheral surface of the separating roller. Therefore, front end sides of the two coins fall together with the displaced conveyance surface, while their rear end sides jump up, so that the area of contact between the upper coin and the separating roller increases, while the area of contact between the lower coin and the conveyance surface decreases. Besides, with the deformed conveyor belt, the front end side of the lower coin is prevented from moving in the coin conveying direction. Further, a metal-to-metal frictional resistance between the lower surface of the upper coin and the upper surface of the lower coin is much smaller than the frictional resistance between the separating roller and the upper surface of the upper coin. Thus, the upper coin can be returned in the separating direction with the force

of the separating roller, whereby the occurrence of a coin pinched state which leads to a locked state can be decreased to the extreme degree.

[0015]

According to the invention defined in claim 2 there is provided a coin separating/delivery unit comprising: a conveyor belt for conveying coins in a coin conveying direction; and a separating roller disposed in opposition to a conveyance surface of the conveyor belt through a gap which permits one coin to pass therethrough at a time, and having a peripheral surface opposed to the conveyance surface of the conveyor belt and being rotatable in a separating direction opposite to the coin conveying direction, characterized in that a recess is formed in a guide plate in a position corresponding to the peripheral surface of the separating roller opposed to the conveyance surface of the conveyor belt, the guide plate being in contact with a non-conveyance surface of the conveyor belt to guide the conveyor belt movably in the coin conveying direction, the recess being formed so as to permit the conveyance surface of the conveyor belt to be deformed in a direction away from the opposed peripheral surface of the separating roller within a range smaller than the total thickness of two coins by utilizing an external force given

from the coins' side when the two coins are being pinched between the conveyance surface of the conveyor belt and the opposed peripheral surface of the separating roller.

[0016]

According to the invention in question, when two coins are being pinched between the conveyance surface of the conveyor belt and the opposed peripheral surface of the separating roller, an external force given from the coins' side pushes the conveyance surface in a direction away from the separating roller. The recess formed in the guide plate permits the conveyor belt to be deformed within the range smaller than the total thickness of the two coins from the opposed surface of the separating roller. Therefore, not only the same function and effect as in the invention of claim 1 are obtained, but also the structure is simple and the cost is low because all that is required is only forming a recess in the guide plate at a position opposed to the separating roller.

[0017]

According to the invention defined in claim 3 the recess is formed so that a rising inclination angle thereof on a downstream side in a coin conveying direction is larger than a falling inclination angle thereof on an upstream side in the coin conveying direction.

[0018]

According to the invention in question, since the rising inclination angle of the recess on the downstream side in the coin conveying direction is large, the upper coin which is being pinched is easier to be prevented from moving in the coin conveying direction and the degree of the pinching can be lightened; besides, the inclination of the lower coin can be made small because the falling inclination angle on the upstream side is small. That is, the area of contact between the lower surface of the upper coin and the upper surface of the lower coin can be made smaller. Thus, not only the same functions and effects as in the inventions of claims 1 and 2 are obtained, but also the occurrence of a pinched state of coins can be decreased to the extreme degree or can be prevented completely.

[0019]

According to the invention defined in claim 4, when it is detected that two coins are pinched between the conveyance surface and the opposed peripheral surface, the conveyor belt can move in the direction opposite to the coin conveying direction and the separating roller can rotate in the direction opposite to the separating direction.

[0020]

According to the invention in question, upon occurrence of a pinched state of two coins due to for example variations in thickness of the coins or due to improper attitude of the coins when introduced, and upon detection thereof, the moving direction of the conveyor belt and the rotating direction of the separating roller are made opposite to those adopted during coin conveyance. As a result, the upper coin remains abutted against the downstream side of the recess where the rising inclination angle of the recess is large, while the area of contact of the lower coin with the conveyance surface of the conveyor belt running along the upstream side of a small falling inclination angle of the recess becomes large, that is, a smooth return of the coil is attained because the returning force acting in the direction opposite to the coin conveying direction increases. Therefore, not only the same functions and effects as in the invention of claim 3 are obtained, but also even in the event of occurrence of a pinched state of coins, it can be cancelled automatically.

[0021]

According to the invention defined in claim 5, the size of the recess in the coin conveying direction is set smaller than a minimum coin diameter.

[0022]

According to the invention in question, even a coin of the smallest diameter does not drop into the recess in its entirety. Therefore, not only the same functions and effects as in the inventions of claims 1 to 4 are obtained, but also even in a mixed state of two types of coins different in diameter it is possible to positively prevent the occurrence of a pinched state of the two coins and cancel the pinched state automatically after the occurrence thereof.

[0023]

[Mode for Carrying Out the Invention]

An embodiment of the present invention will now be described with reference to the drawings. As shown in Fig. 1, a coin separating/delivery unit 10 of this embodiment is the same in its basic construction (11, 20, 30, 40) as the prior art (Fig. 5). However, in the coin separating/ delivery unit 10 of this embodiment, when two coins C1 and C2 are being pinched between the conveyance surface 23F of the conveyor belt 23 and the opposed peripheral surface 31 of the separating roller 30, the conveyance surface 23F can be displaced in a direction away from the opposed peripheral surface 31 of the separating roller 30 within a range smaller than the total thickness (2d) of the two coins C1 and C2.

[0024]

As to the portions common to the prior art (Fig. 5), they are identified by the same reference numerals, and explanations on their constructions and functions will be simplified or omitted.

[0025]

In Fig. 1, a recess 25 is formed on an upper surface side of a guide plate 24 which upper surface is in contact with a non-conveyance surface 23R of a conveyor belt 23 and within a separation area L (see Fig. 5) opposed to a separating roller 30. When two coins (C1 and C2 shown in Fig. 2) are being or have been pinched between a conveyance surface 23F of the conveyor belt 23 and an opposed peripheral surface 31 of the separating roller 30, the recess 25 permits the conveyance surface 23F to be displaced in a direction (downward in Fig. 1) away from the opposed peripheral surface 31 of the separating roller 30 within a range smaller than the total thickness (2d) of the two coins by utilizing an external force (resisting force) given from the coins C1, C2 side.

[0026]

More specifically, when the thickness of coin C1 (C2) is assumed to be d, a maximum thickness D of the recess 25 is determined so as to satisfy the relation of $D<2d$. This

is for preventing a rightward passage of two coins C1 and C2 in Fig. 1. In the case of 500-yen coin of 1.8 mm in thickness, the maximum depth D is, for example, 3.4 mm.

[0027]

As shown in Fig. 2, a rising inclination angle θ2 of the recess 25 on a downstream side in X1 direction is set larger than a falling inclination angle θ1 on an upstream side relative to the same reference line Q. The downstream-side inclination angle θ2 is set large so as to constitute a brake face for preventing a front end C22 of an upper coin C2 from shifting in X1 direction when two coins C1 and C2 are being pinched. The upstream-side inclination angle θ1 is set small so as to increase the area of contact between the lower coin C1 and the conveyance surface 23F. This is for making the attitude of the lower coin C1 more horizontal.

[0028]

The difference between the inclination angles θ1 and θ2 is provided for making large the angle between the upper surface of the lower coin C1 and the lower surface of the upper coin C2 and for making small the area of contact between the upper surface of the upper coin C2 and the lower surface of the lower coin C1. Further, for preventing complete drop of the two coins C1 and C2, the

size L2 in the coin conveying direction (X1) shown in Fig. 1 is set smaller than the minimum coin diameter. It is preferable that the size L2 be larger than half (1/2) of the minimum diameter. In the case where the type of coin applied is one type, the size L2 is set smaller than the diameter d of the coin.

[0029]

In this embodiment, at least the conveyance surface 23F of the conveyor belt 23 and at least the peripheral surface of the separating roller 30 are formed of polyurethane rubber (HNBR) having a hardness of 72 degrees (JIS A). In a normal state, with only the weight of coin C, the conveyor belt 23 is not displaced into the recess 25.

[0030]

Two coins pinching detector means 40 can detect a pinched state of two coins by utilizing a timing discrepancy between a coin detecting operation of an upstream sensor 41 and that of a downstream sensor 42. When a pinched state of coins (coin jam) is detected (YES in ST10 in Fig. 3), a controller (not shown) switches (ST13, ST14) the moving direction of the conveyor belt and the rotating direction of the separating roller to directions reverse to the directions in normal condition (ST11, ST12).

[0031]

Next, a description will be given about the function and operation of this embodiment. In normal condition, as shown in Fig. 1, the conveyor belt 23 (23F) is moved in X1 direction (ST11 in Fig. 3) and the separating roller 30 is rotated in R1 direction (ST12). Since the gap H is smaller than the total thickness (2d) of two coins C1 and C2, coins can be delivered one by one. That is, the upper coin C2 is returned by the separating roller 30 and only the lower coin C1 passes through the gap H. At this time, the conveyor belt 23 (23F) does not displace itself to the recess 25 side because it is only one coin that gets thereon.

[0032]

When two coins C1 and C2 are being pinched between the conveyor belt 23 (conveyance surface 23F) and the separating roller 30 (opposed peripheral surface 31), as shown in Fig. 2(A), a downward external force is exerted on the conveyor belt 23 from the two coins C1 and C2 side. As a result, the conveyor belt 23 is displaced into the recess 25.

[0033]

The front end C22 of the upper coin C2 comes into abutment against the conveyance surface 23F which runs along a steep slant face (27) and is thereby prevented from

moving downstream. The lower coin C1 is pushed against the conveyance surface 23F which runs along a gentle slant face (26). Since both coins C1 and C2 tilt upward on the left side, the area of contact between the upper surface of the upper coin C2 and a contact portion 32 of the separating roller 30 increases. Besides, the larger the angle of the left upward inclination of the upper coin C2, the larger the rate of increase of the contact area.

[0034]

At this time, the lower coin C1 tends to move in X1 direction, but since it is in an attitude of advancing toward the bottom of the recess 25, the component of force in X1 direction which is imparted to the upper coin C1 is small. Besides, the frictional resistance is small because the contact between the lower surface of the upper coin C2 and the upper surface of the lower coin C1 is a metal-to-metal contact. Therefore, as shown in Fig. 2(B), the lower coin C1 strikes against a bent portion 23A of the conveyor belt 23 and cannot move in X1 direction. The upper coin C2 is returned in X22 direction with the force of the separating roller 30 (32). That is, the occurrence of a pinched state which leads to a locked state of two coins C1 and C2 can be prevented.

[0035]

The two coins pinching detector means 40 operates when the two coins C1 and C2 are pinched into a locked state as shown in Fig. 3(A). The controller causes the conveyor belt 23 to move in X2 direction and the separating roller 30 to rotate in R2 direction (YES in ST10 in Fig. 3; ST13, ST14).

[0036]

In this case, the front end C22 of the upper coin C2 strikes against the conveyor belt 23 (23F) which runs along the steep slant face (27) of the recess 25 and hence cannot move in X1 direction. On the other hand, the lower coin C1 comes into contact with the conveyor belt 23 (23F) which runs along the gentle slant face (26), so that the area of contact increases. Besides, the lower coin C1 is urged in X2 direction. Consequently, as shown in Fig. 4(B), the lower coin C1 is moved in X22 direction while the position of the upper coin C2 remains restricted.

[0037]

Thus, in the prior art and Fig. 2(B), by adopting a new operation principle different from the way of thinking that the upper coin C2 is returned from X1 to X22 direction by the separating roller 30, it is possible to cancel a locked state of two coins automatically.

[0038]

According to this embodiment, as described above, when two coins C1 and C2 are being pinched between the conveyance surface 23F of the conveyor belt 23 and the opposed peripheral surface 31 of the separating roller 30, the conveyance surface 23F can be displaced in a direction away from the opposed peripheral surface 31 of the separating roller 30 within a range smaller than the total thickness of the two coins by utilizing an external force provided from the coins' side, whereby it is possible to minimize the occurrence of a pinched state which leads to a locked state.

[0039]

The recess 25 is formed in the guide plate 24 at a position corresponding to the opposed peripheral surface 31 of the separating roller 30, the guide plate 24 being in contact with the non-conveyance surface 23R of the conveyor belt 23 to guide the belt 23 movably in the coin conveying direction (X1 direction). When two coins are being pinched between the conveyance surface 23F of the conveyor belt 23 and the opposed peripheral surface 31 of the separating roller 30, the recess 25 permits the conveyance surface 23F to be displaced in a direction away from the opposed peripheral surface 31 of the separating roller 30 within a range smaller than the total thickness of the two coins by

utilizing an external force given from the coins' side. Thus, the structure is simple and the cost is low.

[0040]

Since the recess 25 is formed so that its rising inclination angle θ2 on the downstream side in the coin conveying direction is larger than its falling inclination angle θ1 on the upstream side, the occurrence of a pinched state of coins can be minimized in a more positive manner.

[0041]

When a pinched state of two coins C1 and C2 between the conveyance surface 23F and the opposed peripheral surface 31 is detected, the conveyor belt 23 is moved in the direction (X2 direction) opposite to the coin conveying direction (X1) and the separating roller 30 is rotated in R2 direction opposite to the separating direction (R1), so that even in the event a pinched state of coins should occur, it can be cancelled automatically.

[0042]

Since the size L2 of the recess 25 in the coin conveying direction (X1) is set smaller than the minimum coin diameter, even when plural types of coins different in diameter are present in a mixed state, it is possible to ensure preventing the occurrence of a pinched state of two coins or automatically canceling the pinched state after

occurrence.

[0043]

Further, since the conveyor belt 23 and the separating roller 30 are formed of polyurethane rubber having a JIS A hardness of 72 degrees, the conveyor belt 23 does not displace to the recess 25 side in normal condition, while when two coins are being pinched between the conveyor belt and the separating roller, the conveyor belt can deform and displace itself along the shape of the recess 25 with an external force provided from the coins' side.

[0044]

If the thickness of each coin (C) is assumed to be d, even if coins of different thicknesses are mixed in the coin receptacle portion 11, they can be applied as they are insofar as the gap H and the allowable displacement D of the recess 25 satisfy the relations of $H<2d$ and $D<2d$, respectively.

[0045]

For example, the thickness d1 of the going coin (1-yen coin) having the smallest diameter is 1.5 mm and the thickness d500 of the going coin (500-yen coin) having the largest diameter is 1.8 mm, so it is seen that the relationship of $H = D<(2\times d1)$ should be satisfied.

[0046]

[Effect of the Invention]

According to the invention of claim 1, when two coins are being pinched between the conveyance surface of the conveyor belt and the opposed peripheral surface of the separating roller, the conveyance surface can be deformed in a direction away from the opposed peripheral surface of the separating roller within a range smaller than the total thickness of the two coins by utilizing an external force given from the coins' side. Consequently, it is possible to minimize the occurrence of the pinched state which leads to a locked state.

[0047]

According to the invention of claim 2, a recess is formed in the guide plate in a position corresponding to the peripheral surface of the separating roller opposed to the conveyance surface of the conveyor belt, the guide plate being in contact with the non-conveyance surface of the conveyor belt to guide the conveyor belt movably in the coin conveying direction, the recess being formed so as to permit the conveyance surface of the conveyor belt to be deformed in a direction away from the opposed peripheral surface of the separating roller within a range smaller than the total thickness of the two coins by utilizing an external force given from the coins' side when the two

coins are being pinched between the conveyance surface of the conveyor belt and the opposed peripheral surface of the separating roller. Consequently, not only the same effect as in the invention of claim 1 is obtained, but also the structure is simple and the cost is low because all that is required is merely forming a recess in the guide plate at a position opposed to the separating roller.

[0048]

According to the invention of claim 3, the recess is formed so that a rising inclination angle thereof on the downstream side in the coin conveying direction is larger than a falling inclination angle thereof on the downstream side in the coin conveying direction. Consequently, not only the same effects as in the inventions of claims 1 and 2 are obtained, but also the occurrence of the pinched state can be minimized in a more positive manner or can be prevented completely.

[0049]

According to the invention of claim 4, when it is detected that two coins are pinched between the conveyance surface and the opposed peripheral surface, the conveyor belt can move in the direction opposite to the coin conveying direction and the separating roller can rotate in the direction opposite to the separating direction.

Consequently, not only the same effects as in the invention of claim 3 are obtained, but also even if the pinched state should occur, it can be cancelled automatically.

[0050]

Further, according to the invention of claim 5, since the size of the recess in the coin conveying direction is set smaller than the minimum coin diameter, not only the same effects as in the inventions of claims 1 to 4 are obtained, but also even in the case where plural types of coins different in diameter are present in a mixed state, it is possible to prevent the occurrence of a pinched state of two coins or cancel the pinched state automatically after occurrence.

[Brief Description of the Drawings]

Fig. 1 is a sectional side view showing an embodiment of the present invention;

Fig. 2 is a diagram for explaining a pinched state canceling operation when two coins are being pinched;

Fig. 3 is a diagram for explaining a pinched state canceling operation upon occurrence of a pinched state of two coins;

Fig. 4 is a flow chart for explaining switching operations with respect to the moving direction of a conveyor belt and the rotating direction of a separating

roller;

Fig. 5 is a sectional side view for explaining a conventional example; and

Fig. 6 is a diagram for explaining a locked state upon occurrence of a pinched state of coins.

[Explanation of Reference Numerals]

10 coin separating/delivery unit

11 coin receptacle section

20 conveyor means

21, 22 rollers

23 conveyor belt

23F conveyance surface

23R non-conveyance surface

24 guide plate

25 recess

30 separating roller

31 opposed peripheral surface

40 two coins pinching detector means

C1, C2 coins

d coin thickness

X1 coin conveying direction

R1 separating direction

H gap (spacing)

θ1, θ2 inclination angles

Fig. 1

10 coin separating/delivery unit

23 conveyor belt

23F conveyance surface

23R non-conveyance surface

24 guide plate

25 recess

30 separating roller

31 opposed peripheral surface

C1, C2 coins

d coin thickness

X1 coin conveying direction

R1 separating direction

H gap (spacing)

θ1, θ2 inclination angles

Fig. 4

Start

ST10 Coin jam detected ?

11 Move the conveyor belt in X1 direction

ST12 Rotate the separating roller in R1 direction

13 Switch the conveyor belt to X2 direction

ST14 Switch the separating roller to R2 direction